



Two Rods Don't Make It Right: Hyatt Regency Walkway Collapse

Leadership ViTS Meeting
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Bryan O'Connor
Chief, Safety and Mission Assurance

Jim Lloyd
Deputy Chief, Safety and Mission Assurance

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National Aeronautics
and Space Administration



Overload

- On July 17th, 1981, guests and spectators filled the lobby and the 2nd, 3rd and 4th floor suspended walkways of the Hyatt Regency Hotel to watch the afternoon “tea dance.”
- Unable to support the load, a support rod connection from the ceiling to the 4th floor walkway ruptured a weld where it penetrated a box beam support element, sparking the progressive failure of all the 5 remaining rod connections sharing, in parallel, the suspended load of both walkways.
- Because the 2nd floor walkway was suspended from the 4th floor walkway, both crashed to the lobby floor in unison.
- 114 people were killed and approximately 200 more were injured.



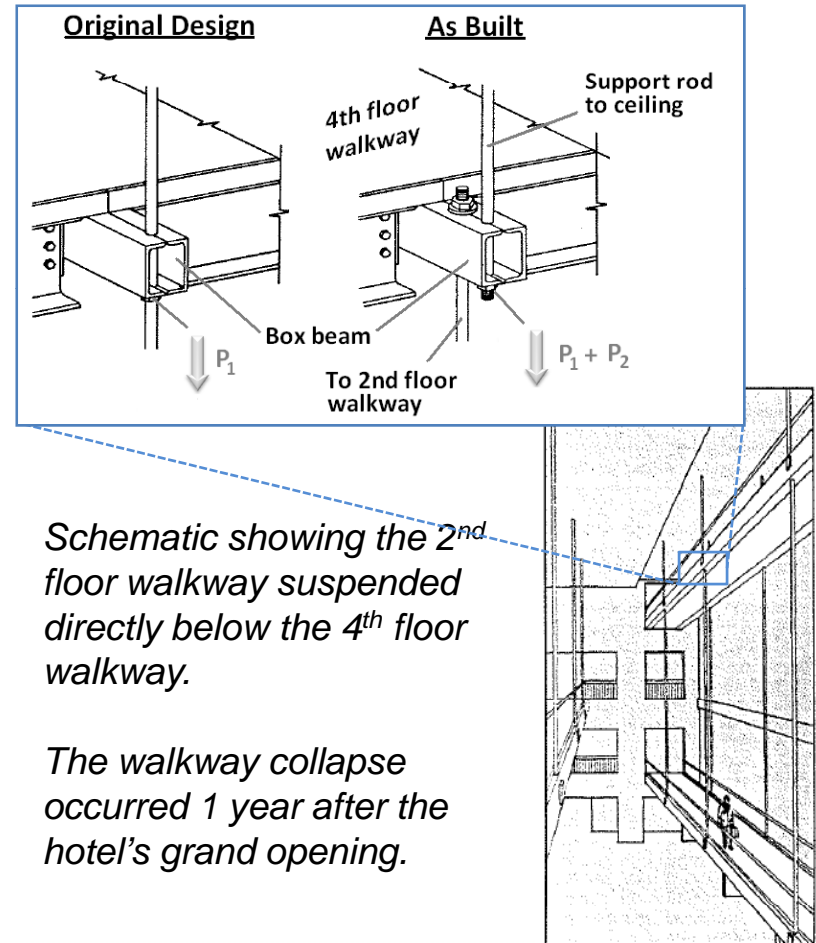
Ruptured box beam on the collapsed walkway.

- At the time, it was labeled the **deadliest structural collapse** in U.S. history.



Flawed Design Change

- Owner, Crown Center Redevelopment, hired PBNMML Architects as the project manager. PBNMML hired design contractor, G.C.E. International. Havens Steel Company was hired as a sub-contractor for the construction.
- G.C.E.'s original design intended for both the 2nd and 4th floor walkways to be connected to the same ceiling support rods penetrating through both walkway box beams. The box beam was carrying only the load of one walkway in this design.
- Since this design would require threading the entire length of the support rods below the 4th floor, Havens Steel changed the single-rod design to a two-rod design. Thus, the 2nd floor walkway was suspended directly from the 4th floor walkway (in contrast to the original design) which effectively doubled the load on the 4th floor box beam weld for the support rod suspended from the ceiling.
- There were no records of any calculations, by either Havens Steel or G.C.E., of the new loads or safety factors for the two-rod design change.





Proximate Cause

- Failure of the box beam weld at the 4th floor walkway box beam and ceiling support rod connection.

Root Causes/Underlying Issues

- **Inadequate design verification process**
 - G.C.E. did not include specifications for the box beam connections in their structural drawings, allowing Havens Steel to determine the final design (explained as a normal practice).
 - Havens Steel's switch to the two-rod connection was approved by G.C.E. without either party recording an analysis of the new loads or safety factors.
 - Post-accident calculations by National Bureau of Standards investigators found that the design supported only about 60% of the required load capacity dictated by the Kansas City Building Code.
- **Lack of accountability and oversight**
 - After a roof collapse during construction, G.C.E. requested additional safety inspections of the entire site. The developer denied these requests, and the safety inspector was instructed to examine only the roof.
 - With numerous contractors, sub-contractors, and overlapping functions, roles and responsibilities were not clearly delineated to each party. Accountability was lost.
 - In addition, both PBNM and the Kansas City Division of Public Works failed to provide adequate oversight.
- **Poor communication between the design team and construction team contractors**
 - G.C.E. management failed to retain critical design information when the senior project designer and project engineer both left the company midway through the design process.
 - The switch to the two-rod design was never fully communicated to the design engineers, and the downgrade in structural integrity went unnoticed.



NASA Applicability

- This mishap underscores the importance of independent engineering analysis and support during the design and design verification processes. All changes and modifications must be thoroughly reviewed and vetted during the change management process.
- With multiple contractors, sub-contractors, and overlapping responsibilities, roles and accountability must be defined and enforced through strong communication and clear ownership of requirements.
- Even for very large projects, attention to the smallest design detail, when critical, can prove to be the difference between success and failure.
- Disciplined design-build processes that include appropriate independent reviews are essential.



View of the 3rd floor walkway (intact) and the pieces of the collapsed walkways below.

“...WHILE THE ENGINEER MAY PROPERLY DELEGATE THE WORK OF PERFORMING ENGINEERING DESIGN FUNCTIONS, HE CANNOT DELEGATE HIS RESPONSIBILITY FOR THE STRUCTURAL ENGINEERING DESIGN ... THIS RESPONSIBILITY IS NOT DELEGABLE.”
AMERICAN SOCIETY OF CIVIL ENGINEERING - 1985